



LAWRENCE
LIVERMORE
NATIONAL
LABORATORY

The Richtmyer-Meshkov Instability in Cylindrical Geometry: Experiments and Simulation

K.S. Budil, J.W. Grove, R.L. Holmes, J.O. Kane,
M.J. Lindquist (nee Graham), B.A. Remington

July 26, 2004

Conference on Analysis Modeling and Computational PDE and
Multiphase Flow
Stony Brook, NY, United States
August 3, 2004 through August 5, 2004

Disclaimer

This document was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor the University of California nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or the University of California. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or the University of California, and shall not be used for advertising or product endorsement purposes.

The Richtmyer-Meshkov Instability in Cylindrical Geometry: Experiments and Simulation



**K. S. Budil¹, J.W.Grove², R.L. Holmes²,
J.O. Kane¹, M.J. Lindquist¹(nee Graham),
and B. A. Remington¹**

**Conference on Analysis, Modeling and
Computational PDE and Multiphase Flow
University at Stony Brook
August 3-5, 2004**

¹Lawrence Livermore National Laboratory

²Los Alamos National Laboratory

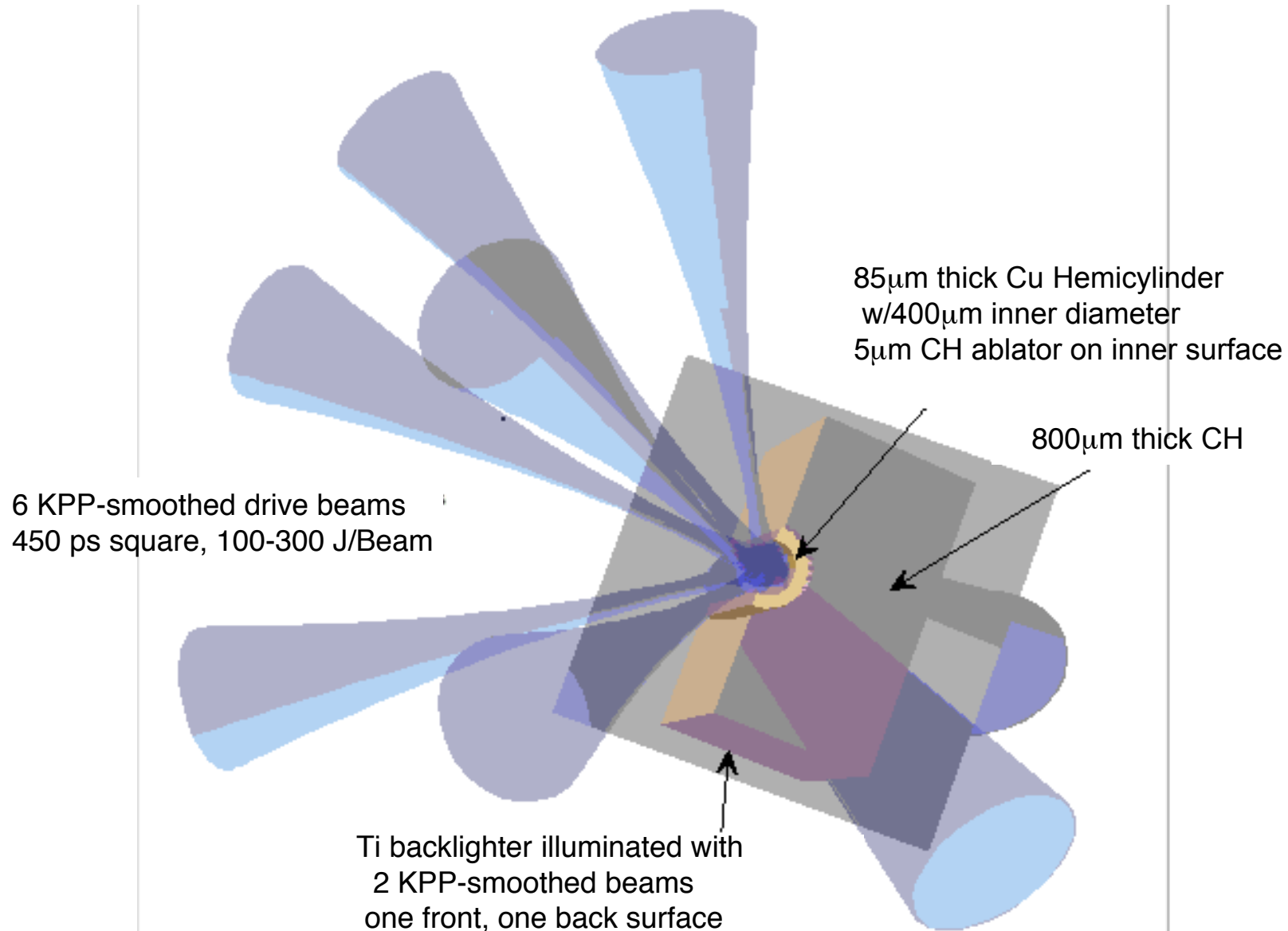
**Work performed under the auspices of the U.S. Department of Energy by the Lawrence
Livermore National Laboratory under Contract No. W-7405-Eng-48**

Outline



- Motivation/Objective of study
- Experimental setup
- Method of solution
- Preliminary results
- Conclusion

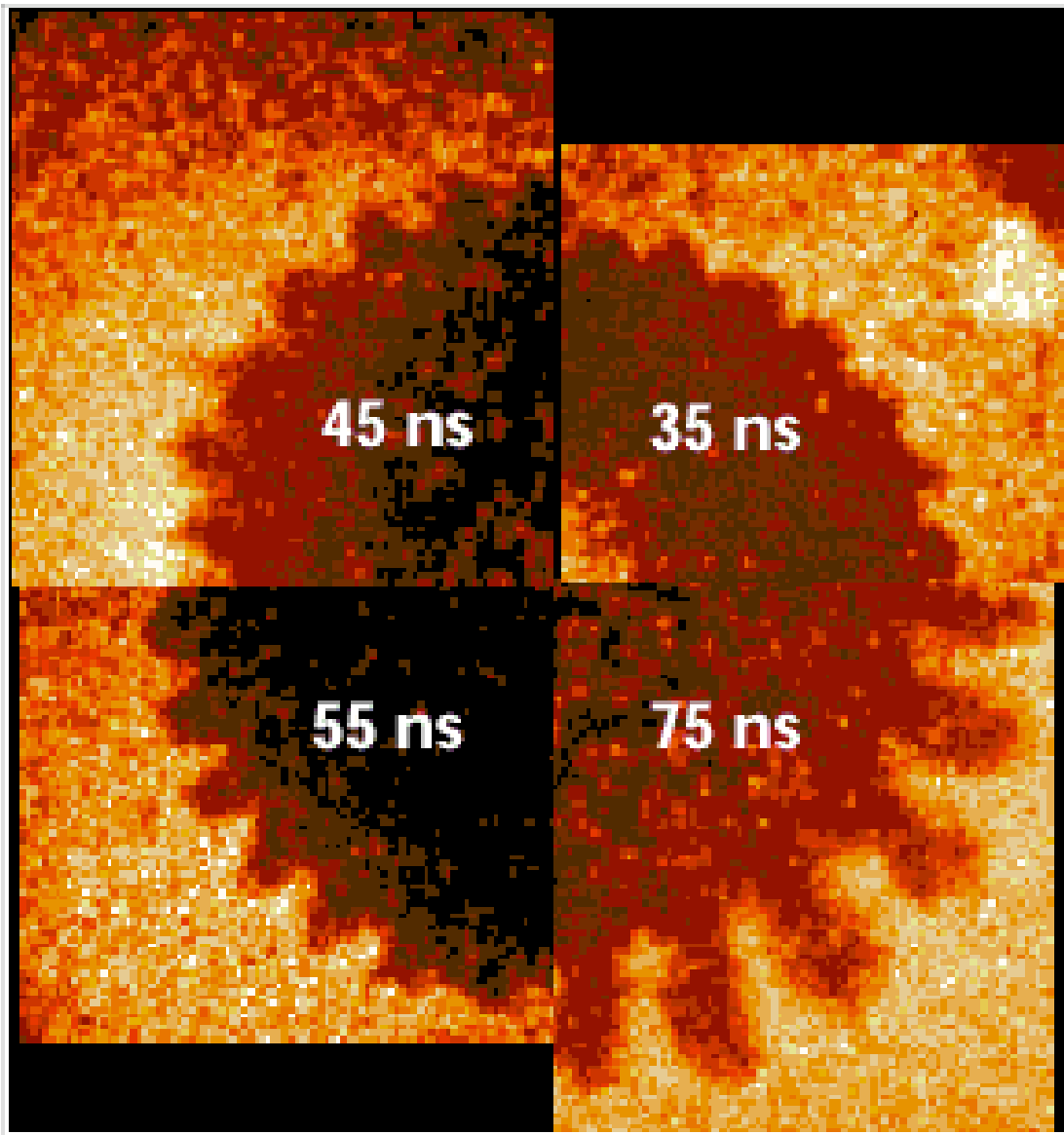
Experimental configuration for the DIVRM



Radiographs of the instability evolution



Shot 29012006
404.98J

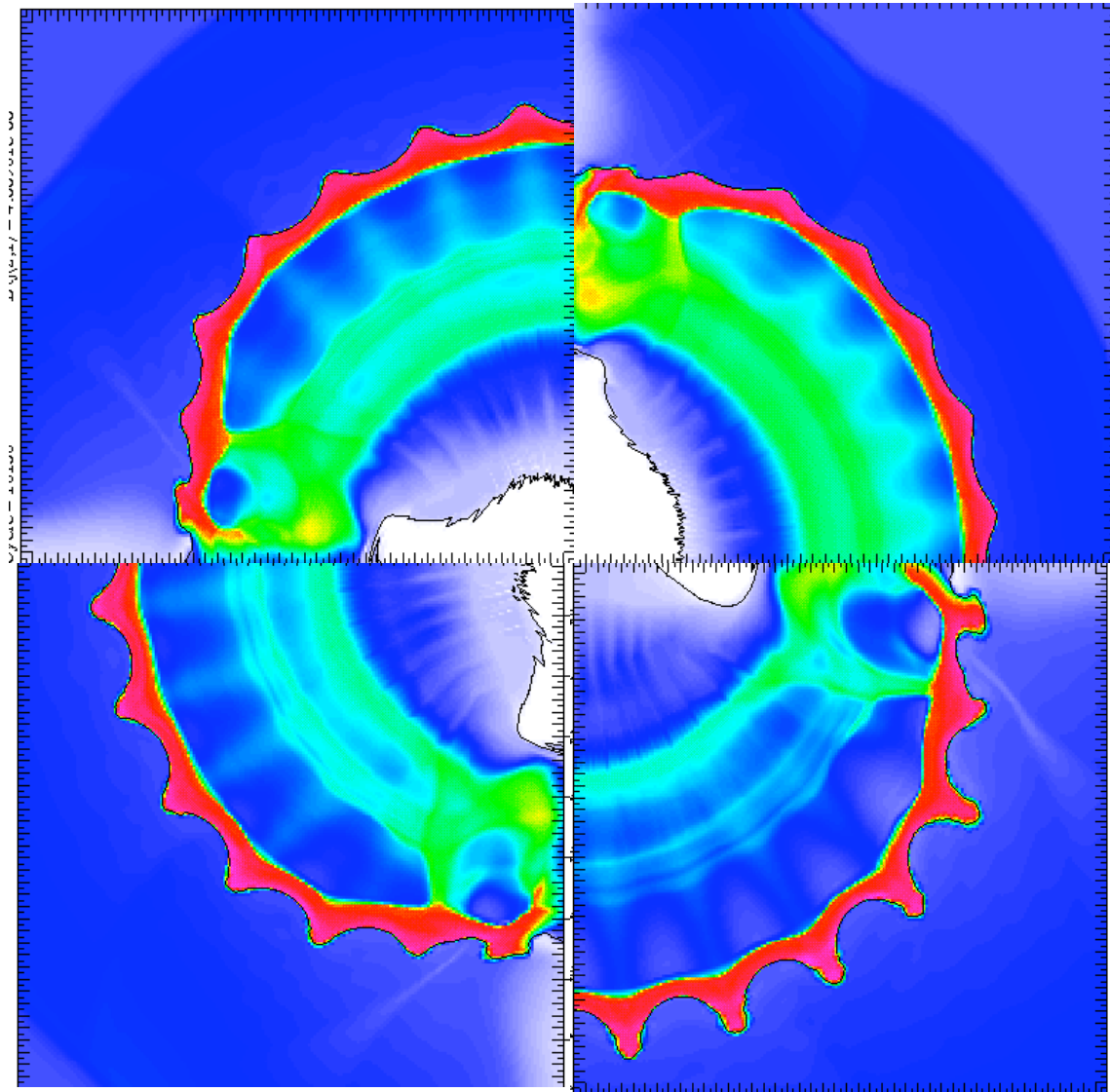


Shot 29012003
495.37J

Shot 29012011
493.69J

Shot 29012003
1714.00J

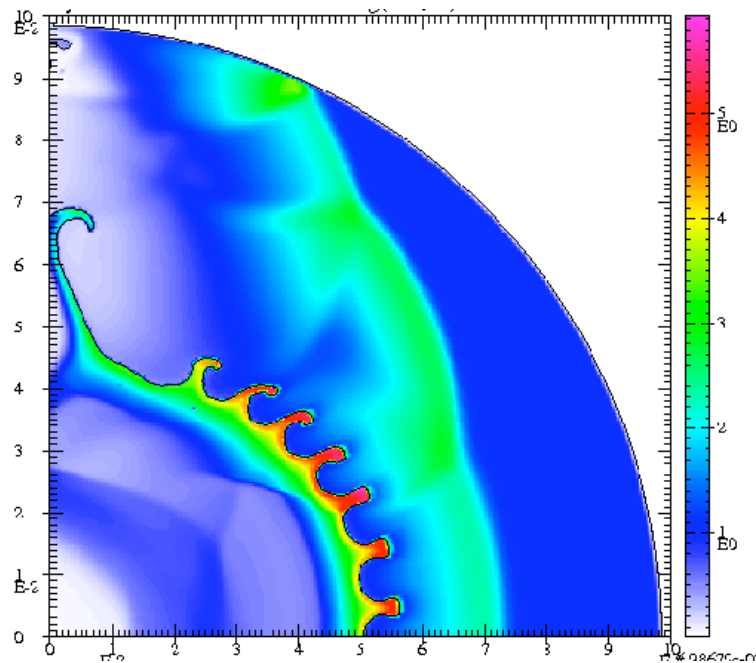
Evolution of the DIVRM (density distribution)



Evolution of the DIVRM (density distribution)

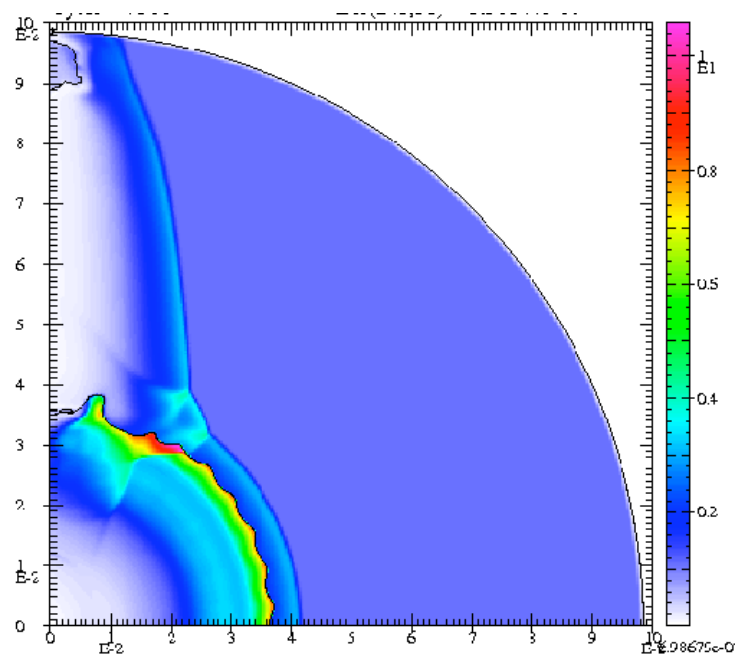


Shot 29012003
495.37J 35ns



overestimate amplitude
radiograph time (58 μm)

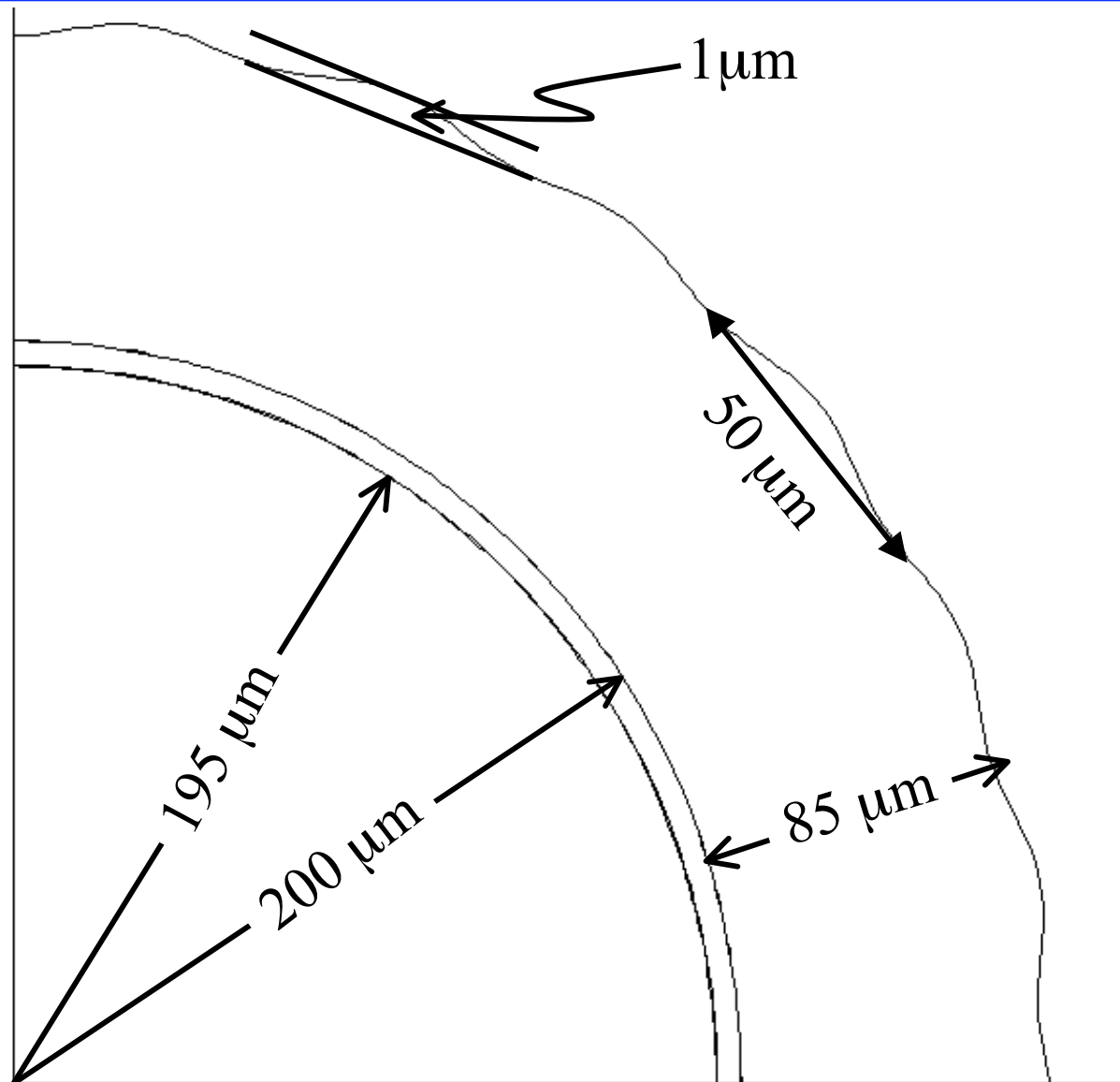
Shot 29012003
495.37J 353 μm



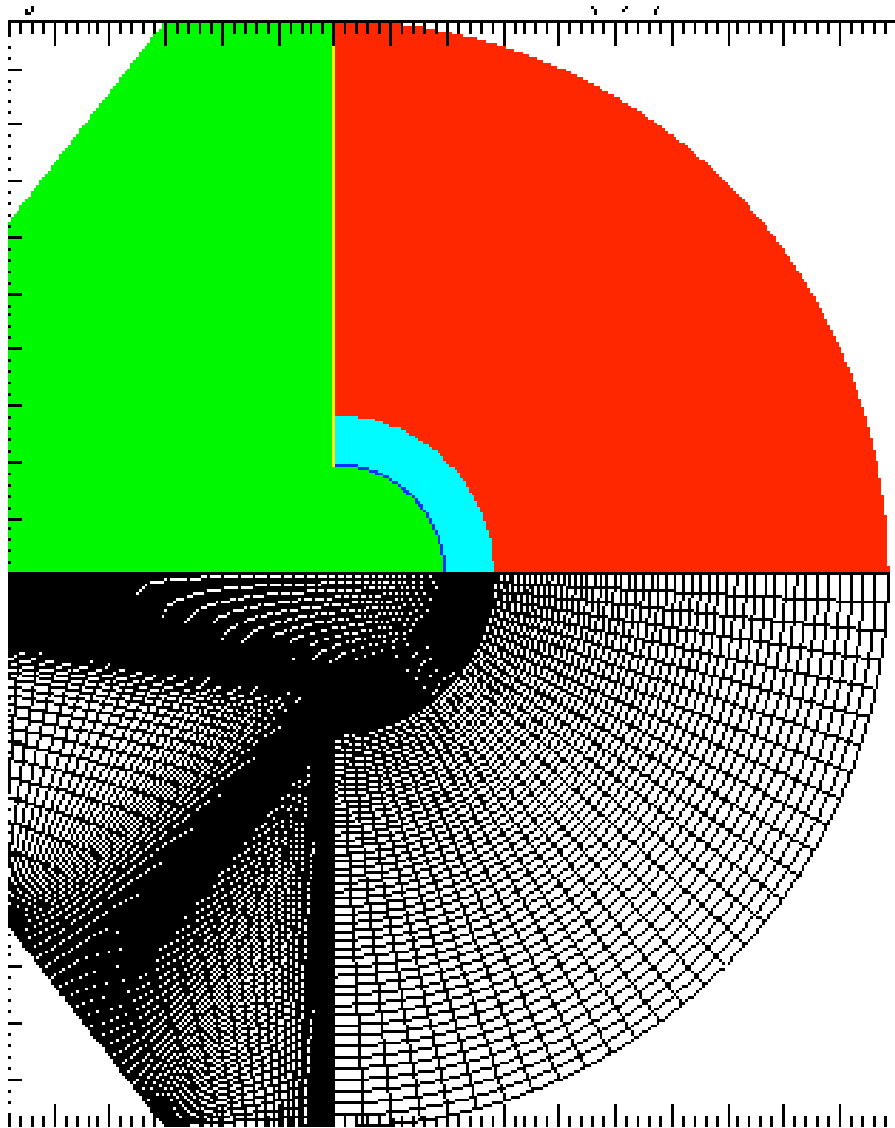
underestimate amplitude at average
position radiograph time (6.5 microns)

PV amplitude 23.1 μm

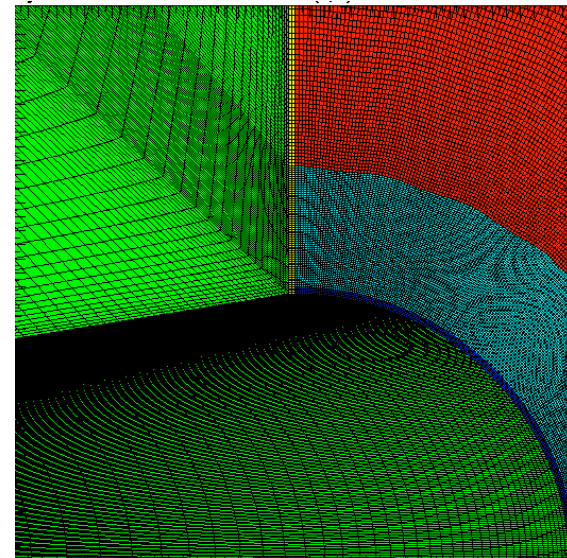
Schematic of the initial interface



Material regions and initial mesh.

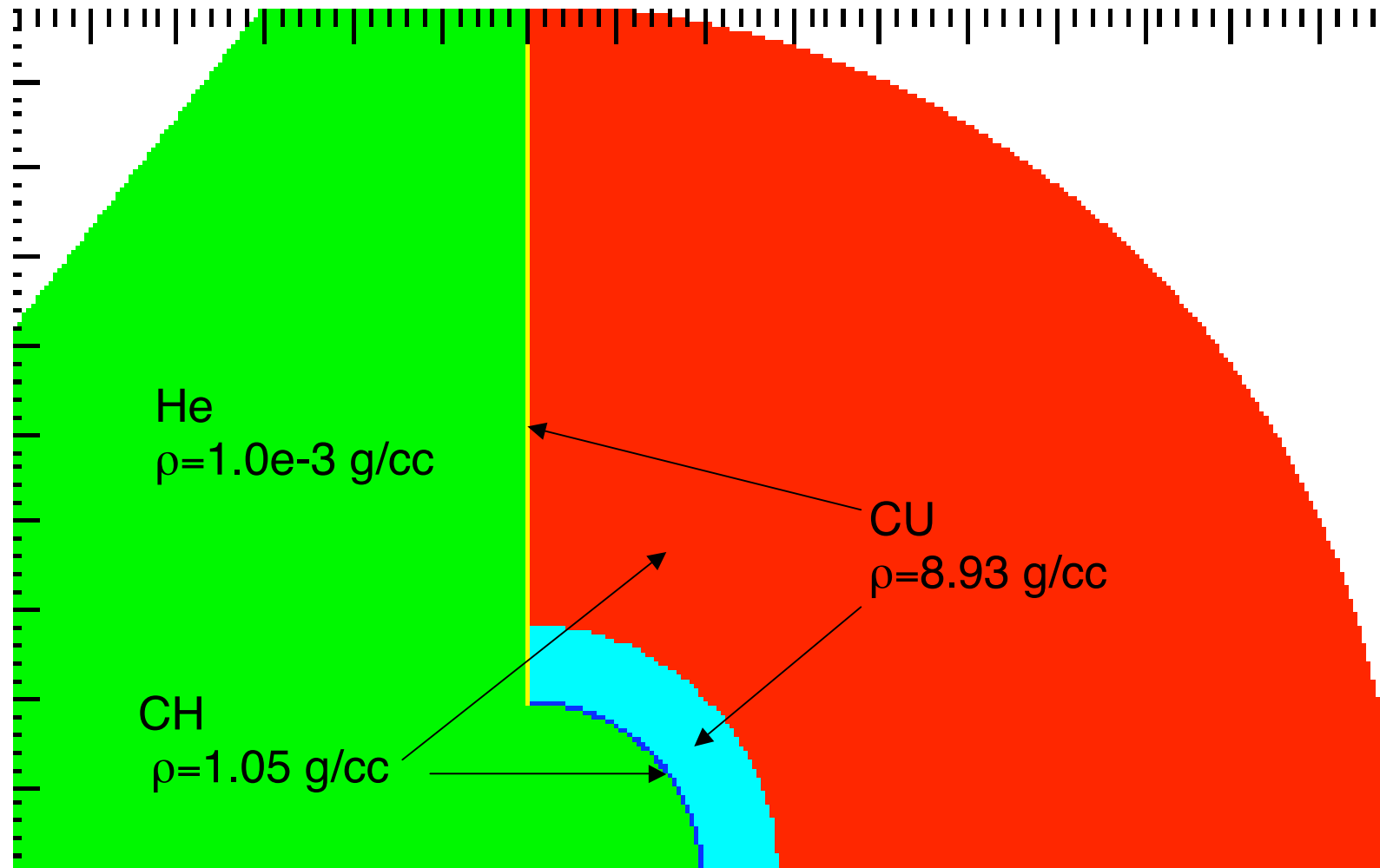


Zoom corner (base) CU shield



Non-uniform grid (242 x 214 zones).
Cylindrical coordinate system

Initial Conditions



Single-mode sinusoidal perturbation

Experimental and Computed Amplitude



<u>Time (ns)</u>	<u>Experiment</u>	<u>Computation</u>
35	23.1	12.0
45	37.4	22.0
55	43.5	26.5
75	101.0	45.0

Method of solution:
CALE (C-based Arbitrary Lagrangian-Eulerian)



- Tabulated EOS for material components
- Rosseland opacities
- Laser energy deposited by ray-tracing beamlets. The beamlets that compose the laser source fan out from the focal point at the origin at an angle of 71 degs from the symmetry axis. The energy deposition pattern on the inner CH surface of the target matches the uniform profile.

Future Work



- Examination of amplitude discrepancy
- Is the drive incorrect?
- Verify energy deposition
- Detailed examination of amplitude
- Comparison to be performed with RAGE